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WIND RIVER OVERCOMES "MATRIX OF PAIN" IN IOT CHALLENGES WITH SIMICS VIRTUAL TESTING ENVIRONMENT

Embedded Software Maker Saving More Than $3 Million in Hardware Costs While Dramatically Improving Both Quality and Speed of Its Testing Processes

Company Profile
Wind River

Industry
Embedded software;
IoT development

Solutions Used
- Wind River Simics

Results
- Much faster testing process
- More accurate testing
- Greater engineer productivity
- Easier global collaboration
- Ability to test IoT software at enormous scale

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The maxim, "Nothing beats the real thing," has been put to the test at Wind River®.

By using Wind River Simics®, a pioneering virtual tooling environment, the company is reaping widespread benefits for its software production processes.

Engineering teams across Wind River are using Simics to gain dramatic efficiency improvements and eliminate many of the costs and complications of testing on physical hardware. But perhaps more significantly, Simics allows Wind River to do what would be impossible with hardware-based labs: test the Internet of Things (IoT) at full scale.

THE CHALLENGE

Overcoming the Constraints of Embedded Software Testing

Rabih Maalouf, Wind River vice president of worldwide engineering, says Simics is helping his teams overcome a perennial challenge facing many software developers: doing more and doing it better. Wind River is rapidly branching into new product areas as the company's work on IoT expands. At the same time, his teams continue to ensure the quality and support for existing products.

Perhaps the biggest challenge to the Wind River testing processes is what Philippe Maisonneuve, a senior director of engineering, describes as the "matrix of pain"—the often sprawling combination of hardware configurations, including different host machines, OS versions, compilers, and processor architectures, that Wind River teams need to ensure will work with its software.

This requirement to test such an expansive set of hardware and software configurations is further complicated by new agile and continuous development methods. Like most developers, Wind River is moving to agile and continuous development to meet the rapidly evolving demands of modern software production.

But such methods are particularly challenging for embedded software. Unlike their counterparts who develop for websites, desktop applications, or other software-based platforms, embedded developers build software directly on hardware. And that has made rapid testing far more difficult for Wind River and others in the embedded industry.

"New code comes in every hour on the hour," Maisonneuve says. "To do all of that manually on each instance of a different piece of hardware would take an army."

And now with growing adoption of IoT, Wind River software teams face new, even more daunting challenges: testing at massive scales for systems running hundreds or thousands of devices.

In a typical scenario, just the cost of purchasing 1,000 devices would be roughly $2 million, says Ed Illidge, Wind River vice president of engineering and testing management. Add to that the logistical nightmare of setting up and maintaining all of these devices in a lab, and any sort of testing for IoT becomes unfeasible. "Without a way to test at such scale, we can't guarantee the performance of our software," Illidge says.

THE APPROACH

Freeing Testing from the Lab with Virtualized Hardware

As Wind River is discovering, Simics not only provides a host of intrinsic advantages that improve upon the limitations of physical hardware labs, but also offers all-new capabilities previously impossible with physical hardware testing.

Simics brings new possibilities to embedded software testing by helping greatly improve the access to hardware test systems, radically boosting how teams can automate testing tasks, and opening up new ways global software teams can collaborate.

With Simics, once you build a virtual hardware target model, you can use it forever, which eliminates most of the costs and effort required to maintain and troubleshoot physical hardware.

Illidge says Simics also makes it possible to test on hardware that is no longer available. "That's a nice perk when you need to ensure software will work with older installed devices that have been taken off the market," he says.

Simics makes it possible for Wind River engineering teams to create as many "targets" (hardware/host configurations) as they need to address the dreaded matrix of pain. A test suite can automatically run overnight and capture any faults, preserving those for engineers to review the next day.

And because it is virtual, all engineers across Wind River global teams have the same view and are equally able to run tests on the same hardware targets. Simics makes it simple to freeze a test at a certain state and then share that with a colleague.

Maisonneuve also says Simics helps his team in two key ways when it comes to debugging. First, it allows engineers to reverse debug, making it possible to work back in time through the code to find a point of failure. Second, Simics makes it possible to easily test and debug at the lowest code levels to view and solve for problems, regardless of where they are in the system—from firmware up to the application level. "Simics removes the blind spots of debugging systems," Maisonneuve says.

> "Simics allows us to spend far less time and resources on testing, which frees our teams to focus more on design and build challenges." —Rabih Maalouf, Vice President, Worldwide Engineering, Wind River

THE RESULTS

Bringing Unprecedented Speed, Ease of Collaboration, and Scale to Embedded Testing Processes

Some teams at Wind River have been using Simics for several years, while others have adopted Simics more recently. In all cases, they are finding dramatic benefits.

The most important benefit of Simics has been the speed of testing, which has directly improved both quality and engineering productivity. Time-to-quality has been significantly reduced. "The more you can test, the more you can ensure quality," Maalouf says. "Simics allows us to spend far less time and resources on testing, which frees our teams to focus more on design and build challenges."

Wind River engineering teams can run many more tests and more types of test much more quickly than with traditional methods, helping them rapidly move through the matrix of pain far more easily than in the past.

Overall, Maisonneuve says Simics is much more predictable than physical hardware. With Simics, it is easy to find and replicate an error. "That is a huge reduction in engineering effort," he says. "We can find a tough bug in a few hours rather than days or weeks. That's saving us hundreds of thousands dollars in engineering time each year."

Illidge says Simics is also eliminating more that $3 million in costs from hardware purchases. Wind River is also reducing expenses for lab space and electrical power.

Illidge says adopting Simics was part of a broader program he put in place to increase the efficiencies of the Wind River testing program. "I had a vision for the test team that Simics is helping us reach," he says. "First, we wanted to perform end-to-end testing, just as our customers would use our products. Second, we wanted to reach 100 percent pass rate with 99 percent reliability."

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A big part of Illidge's vision was to find a way to have complete confidence that any problems found were due to software bugs and not because of lab equipment hardware faults. For example, Illidge's team typically runs thousands of tests every night. Without Simics, they wouldn't be able to quickly identify what caused a failure in one of those tests. But Simics captures and logs any faults in automated tests, making it easy for an engineer to see exactly what happened when they check into Simics the next morning.

Illidge says the stability of the Wind River test systems have improved by 40% thanks to virtualization. "Simics has played a big role in that," he says.

The reliability of virtual hardware-based testing has also had a huge impact on productivity. Illidge says his ultimate goal is to reduce test execution time down to minutes.

The virtual nature of Simics artifacts also makes it simple to share hardware and show bug problems to colleagues, even if they are half a world away and still asleep. Maisonneuve's team, for example, is scattered around the globe in France, Austria, and China. With Simics, they can put a breakpoint in Simics and send to a colleague to follow up on when they start working the next day. Team leads report that when they don't have access to Simics, projects typically take 20 percent to 30 percent longer.

Making Testing on the Internet of Things Possible

Besides helping Wind River greatly improve its existing testing process, Simics' revolutionary ability to represent hardware systems virtually is helping Wind River and its engineering teams test the impossible. Wind River Helix™ Device Cloud, for example, must dependably manage hundreds or thousands of IoT devices. "The more complicated the scenario, the more Simics helps," Maalouf says. "It really excels at testing at scale."

This is especially true with IoT. These systems need holistic testing to check the functions of hundreds or thousands of devices working across complex networks. Simics' ability to "spin up" hardware targets is proving particularly invaluable for tackling the massive scale and complexities of testing for IoT.

"Simics supports testing of any kind of IoT device and connection scenario," Illidge says. "Such testing is simply not possible any other way. Without Simics, we wouldn't be able to guarantee the performance of our software for IoT implementations. We would have to deploy and hope."

With Simics, his team can even simulate a "day in the life" of a real IoT system, gaining insights and eliminating problems before the first device is ever deployed.

Illidge says his team is now testing as many as 1,000 devices on Simics, but is looking to scale up to 10,000 devices.

Illidge notes that Simics helps with functional testing tasks, while performance testing is still carried out on physical hardware. Still, the scope of improvements Simics has delivered has been transformational, he says.

Though Simics can bring dramatic benefits to embedded software development teams, Wind River engineers say it is important to keep a couple of caveats in mind. First, it takes time to build a virtual hardware target model, so the more a target can be reused, the better the return on investment—for example, using it both for debugging and for large scale testing.

Also, Simics takes time to learn. It is powerful and has many capabilities. Maisonneuve recommends that teams start small and focus on using one or two of its features for a given project.

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> —Rabih Maalouf, Vice President, Worldwide Engineering, Wind River

Teams can also start quickly and easily with Wind River Helix Lab Cloud, a simplified, cloud-based version of Simics.

Once a team gets familiar with Simics, it can then look at integrating other Simics capabilities into its routine.

"There is an investment you will need to make to master it," Maisonneuve says. "But when you do, your engineers will be freed to focus on their talents to build great software rather than being trapped in the matrix of pain."

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Wind River is a world leader in embedded software for intelligent connected systems. The company has been pioneering computing inside embedded devices since 1981, and its technology is found in more than 2 billion products. To learn more, visit Wind River at www.windriver.com.

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